ZooKeys 1206: 327–342 (2024)
DOI: 10.3897/zookeys.1206.122469

Research Article

The tiniest violin: the male of *Loxosceles vallenar* (Araneae, Sicariidae)

Ivan L. F. Magalhaes[1], Hernán A. Iuri[1], Antonio D. Brescovit[2], Jaime Pizarro-Araya[3,4,5,6]

1 *División Aracnología, Museo Argentino de Ciencias Naturales "Bernardino Rivadavia" – CONICET, Av. Angel Gallardo 470, C1405DJR, Buenos Aires, Argentina*
2 *Laboratório de Coleções Zoológicas, Instituto Butantan, Av. Vital Brasil, 1500, 05503-900, São Paulo, SP, Brazil*
3 *Laboratorio de Entomología Ecológica (LEULS), Departamento de Biología, Facultad de Ciencias, Universidad de La Serena, Casilla 554, La Serena, Chile*
4 *Programa de Doctorado en Conservación y Gestión de la Biodiversidad, Facultad de Ciencias, Universidad Santo Tomás, Ejército 146, Santiago, Chile*
5 *Instituto de Ecología y Biodiversidad (IEB), Ñuñoa, Santiago, Chile*
6 *Grupo de Artrópodos, Sistema Integrado de Monitoreo y Evaluación de Ecosistemas Forestales Nativos (SIMEF), Santiago, Chile*

Corresponding author: Ivan L. F. Magalhaes (magalhaes@macn.gov.ar)

Abstract

In recent years, several endemic species of *Loxosceles*, violin spiders, have been described from the North-Central Chile biodiversity hotspot, some of which have ambiguous placement within the species groups of the genus. In a recent expedition to the Atacama region, we collected male specimens representing new records of two recently described species: *Loxosceles vicentei* Taucare-Ríos, Brescovit & Villablanca, 2022 and *Loxosceles vallenar* Brescovit, Taucare-Ríos, Magalhaes & Santos, 2017 (Araneae, Sicariidae). Males of the latter are hitherto unknown and are here described for the first time. Examination of the morphology of these species revealed characters such as an embolic keel and digitiform median receptacles, which suggest they do not belong in the *laeta* species group, but rather in the *spadicea* species group, which is briefly re-diagnosed. With carapace lengths smaller than 2 mm, the newly discovered males of *L. vallenar* are the tiniest members of the genus. In addition, males of this species bear strong macrosetae in the clypeus, a sexually dimorphic character not previously reported in *Loxosceles*.

Key words: Atacama, brown recluse spider, Chile, desert, Matorral, sexual dimorphism, taxonomy, violin spider

OPEN ACCESS

Academic editor: Cristina Rheims
Received: 7 March 2024
Accepted: 27 May 2024
Published: 11 July 2024

ZooBank: https://zoobank.org/4CD78168-C16E-4D3D-AAA2-8BF769CC1E65

Citation: Magalhaes ILF, Iuri HA, Brescovit AD, Pizarro-Araya J (2024) The tiniest violin: the male of *Loxosceles vallenar* (Araneae, Sicariidae). ZooKeys 1206: 327–342. https://doi.org/10.3897/zookeys.1206.122469

Copyright: © Ivan L. F. Magalhaes et al. This is an open access article distributed under terms of the Creative Commons Attribution License (Attribution 4.0 International – CC BY 4.0).

Introduction

Central Chile is renowned as a biodiversity hotspot (Myers et al. 2000; Mittermeier et al. 2011). However, there are knowledge gaps for its arthropod species, specifically referring to Linnean and Wallacean shortfalls, resulting in challenges for regional conservation (Vergara-Asenjo et al. 2023). Regarding spiders, numerous new species have been described in the last decade, partially tackling such shortfalls (e.g., Laborda et al. 2013; Bustamante et al. 2014; Brescovit and Sánchez-Ruiz 2016; Grismado and Pizarro-Araya 2016; Brescovit et al. 2017; Griotti et al. 2022; Taucare-Ríos et al. 2022). In particular, the spider genus *Loxosceles* includes five species endemic to Central Chile: *L. coquimbo*

Gertsch, 1967, *L. diaguita* Brescovit, Taucare-Ríos, Magalhaes & Santos, 2017, *L. pallalla* Brescovit, Taucare-Ríos, Magalhaes & Santos, 2017, *L. vallenar* Brescovit, Taucare-Ríos, Magalhaes & Santos, 2017 and *L. vicentei* Taucare-Ríos, Brescovit & Villablanca, 2022. Four of these have been described in the last decade, indicating that the diversity of this medically important genus has been previously underestimated in Chile.

Loxosceles violin spiders include 149 species occurring naturally mainly in Africa, the Americas and the Mediterranean region (WSC 2024). The genus dates back to the Cretaceous (Binford et al. 2008; Magalhaes et al. 2019), and due to its high morphological and taxonomic diversity, it has been separated into several species groups (Gertsch 1967), most of which have resisted the scrutiny of phylogenetic analyses (Binford et al. 2008). Three of the Central Chile endemics have been placed in the *laeta* species group – *L. coquimbo*, *L. vallenar* and *L. vicentei* – and thus were assumed to be closely related to *Loxosceles laeta* (Nicolet, 1849), a species that may cause serious injury in humans due to the dermonecrotic activity of its venom (Schenone et al. 1989). The other two species have been placed tentatively in the *spadicea* species group (*L. diaguita*) or left unplaced due to its aberrant genital morphology (*L. pallalla*) (see Brescovit et al. 2017). This seems to indicate that the *laeta* species group is the most diverse among Chilean species.

In a recent expedition to Boquerón Chañar (Fig. 1), an area in the Atacama region, Chile (Fig. 2), we collected males of *Loxosceles* that did not fit with any described specimens in the literature, mainly because of the modified clypeal macrosetae (Fig. 3). In the same area, we found a similar-sized female specimen of *Loxosceles vallenar* (Fig. 4B–E), a species hitherto known only by the females, which led us to conclude that the undescribed males are conspecific with them. In addition to describing this male, the new specimens prompted us to re-evaluate the placement of Chilean *Loxosceles* in the different species

Figure 1. Habitat in Boquerón Chañar, Atacama, where *Loxosceles vallenar* and *L. vicentei* were collected.

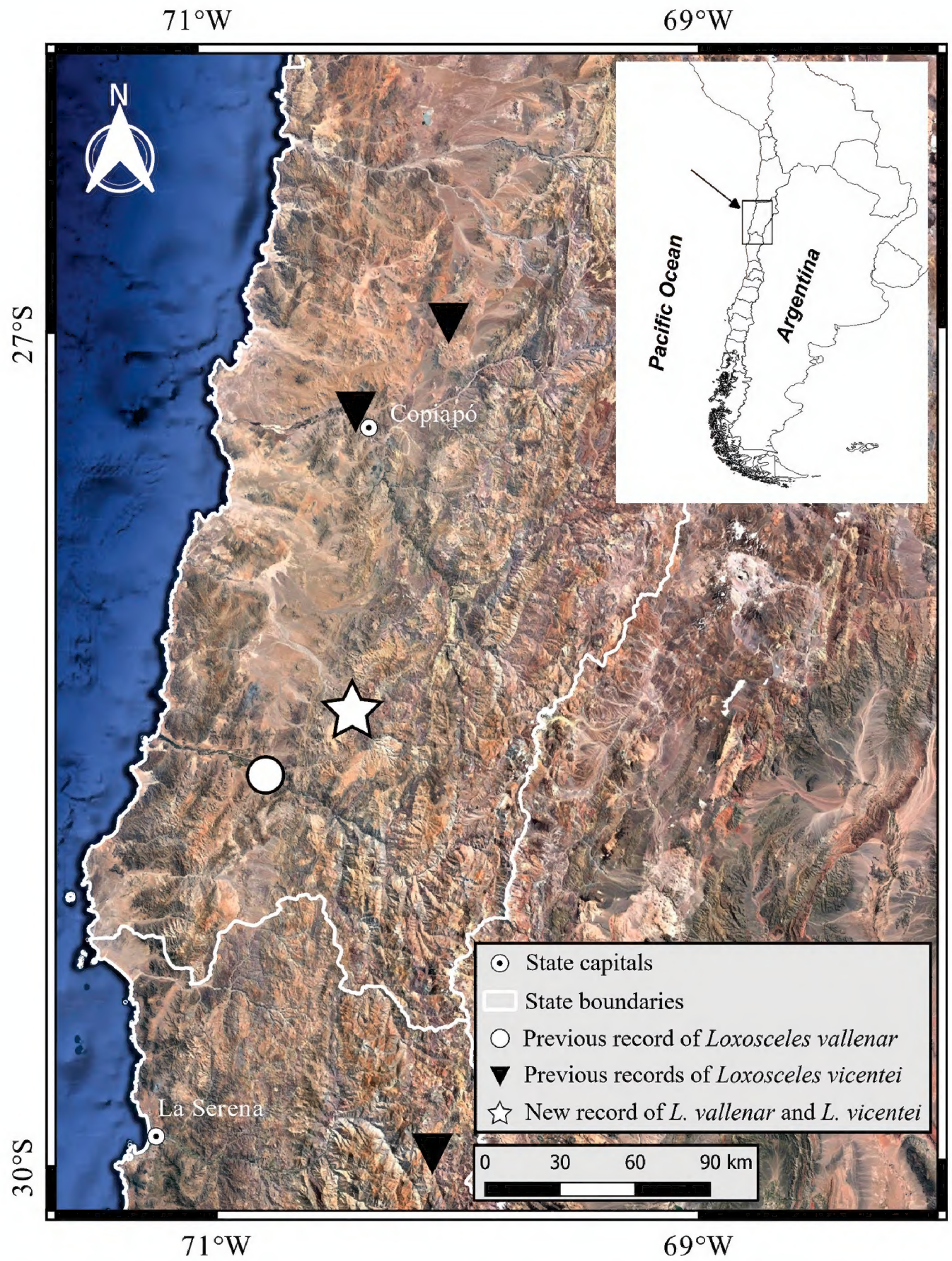

Figure 2. Distribution of *Loxosceles vallenar* and *Loxosceles vicentei*. The star represents a new record for both species in the same locality.

groups, as the newly discovered specimen does not present characters consistent with the *laeta* species group. Finally, we report sexually dimorphic characters that had not been previously described in *Loxosceles*.

Material and methods

Fieldwork

Specimen collection was performed during November 2023 (late spring) in several places of Quebrada Algarrobal, near Boquerón Chañar, in the Atacama region. The specimens were manually collected by searching on the ground at night using a headlight. Photographs of the live specimens were taken with an Olympus Tough TG-5 digital camera.

Microscopy

Endogynes were examined in lactic acid after digestion using pancreatin solution (Álvarez-Padilla and Hormiga 2008). Images of the holotype were taken with a Leica DM4000B Microscope and a Leica M205C stereomicroscope at Instituto Butantan, São Paulo. For other specimens, images in multiple focal planes were taken with a Leica M205C stereomicroscope or an Olympus BH2 compound microscope in Museo Argentino de Ciencias Naturales Bernardino Rivadavia (MACN), Buenos Aires, and then combined with Helicon Focus 7 (HeliconSoft, Kharkiv, Ukraine); a camera lucida was used to make a schematic drawing. Material for scanning electron microscopy was dried in a series of ethanol solutions of increasing concentrations, with a final step of reagent-grade, pure hexamethyldisilazane (Sigma-Aldrich), and then air-dried. Samples were mounted on aluminum stubs and sputter coated with gold-palladium, and then examined under a high vacuum with a Zeiss GeminiSEM 360 scanning electron microscope in MACN.

Description

The format of the description follows Brescovit et al. (2017), with slight modifications; leg measurements are given as total length (femur, patella, tibia, metatarsus and tarsus lengths). Descriptions and lists of examined material were prepared using automated spreadsheets (Magalhaes 2019). Specimens whose geographical coordinates are placed between square brackets were georeferenced by us using Google Earth (Google, Mountain View, USA); coordinates placed between parentheses represent those on the original labels. Geographic coordinates of the collecting sites were recorded using a GPS Garmin eTrex, Vista C. The distribution map was generated using QGIS 3.22.10-Białowieża (distributed under the GNU General Public License, www.gnu.org/licenses) using Land-Sat satellite images (Chávez 1996; Chander and Markham 2003) and supporting cartography from the Instituto Geográfico Militar at a scale of 1:250,000 (IGM 1986).

Collections

The material studied in this paper is deposited in the American Museum of Natural History, New York, U.S.A. (AMNH; curator L. Prendini) and in the Museo Argentino de Ciencias Naturales “Bernardino Rivadavia”, Buenos Aires, Argentina (MACN-Ar; curator M.J. Ramírez).

Taxonomy

Family Sicariidae Keyserling, 1880
***Loxosceles* Heineken & Lowe, 1832**

The *spadicea* species group

Diagnosis. Small to medium-sized *Loxosceles* (body length 2–8 mm). The carapace may be uniform brown or orange (e.g., *L. vallenar*, *L. hirsuta*, *L. diaguita*;

Fig. 4B) or bear distinctive markings (e.g., *L. vicentei*; Taucare-Ríos et al. 2022, fig. 1), and may be distinctly hirsute. The leg formula is usually 2413, but may be 2143 in some females, and 4213 in some species (*L. vicentei* males and females, *L. vallenar* females). The most distinctive features of the group are in the genitalia: the female genitalia have the receptacles separated by two to several times their width at the base, and the receptacles are short and digitiform, usually bearing a small head (Fig. 5); the uterus externus and the interpulmonary fold are not particularly sclerotized or modified. Male palps have the cymbium short and diamond-shaped (Fig. 6B); the bulb is always globose at the base, and the embolus always bears a keel ("wing or carina" sensu Gertsch 1967) (Figs 7–9, arrows); the embolus may be quite short (Fig. 7) to quite long (Brescovit et al. 2017, fig. 7). The first metatarsi of males are unmodified.

Species included. So far, the group encompasses *L. hirsuta* Mello-Leitão, *L. intermedia* Mello-Leitão, *L. spadicea* Simon, *L. anomala* Mello-Leitão and *L. diaguita*. We argue that, based on the diagnosis above, the following species also belong in the group: *L. vallenar*, *L. coquimbo*, *L. vicentei*, and *L. pallalla*.

Loxosceles vallenar Brescovit, Taucare-Ríos, Magalhaes & Santos, 2017

Figs 3–8

Loxosceles vallenar Brescovit, Taucare-Ríos, Magalhaes & Santos, 2017: 14, fig. 8E.

Holotype (examined). Chile • 1 ♀; Atacama, Prov. Huasco, Vallenar, 3 km S Vallenar; 460 m.a.s.l. [28.601°S, 70.77°W]; 7 Jan. 1985; N Platnick, O Francke leg.; deposited in AMNH.

New records. Chile • 1 ♂; Atacama, Prov. Huasco, Boquerón Chañar; Algarrobal; 992 m.a.s.l.; (28.3708°S, 70.4128°W); 24–25 Nov. 2022; J Pizarro-Araya, FM Alfaro, JE Barriga, AA Ojanguren-Affilastro, HA Iuri & JE Calderón leg.; IFM-2580; MACN-Ar 44129 • 1 ♂; same collecting data; MACN-Ar 44130 • 1 ♀; same collecting data; MACN-Ar 44131.

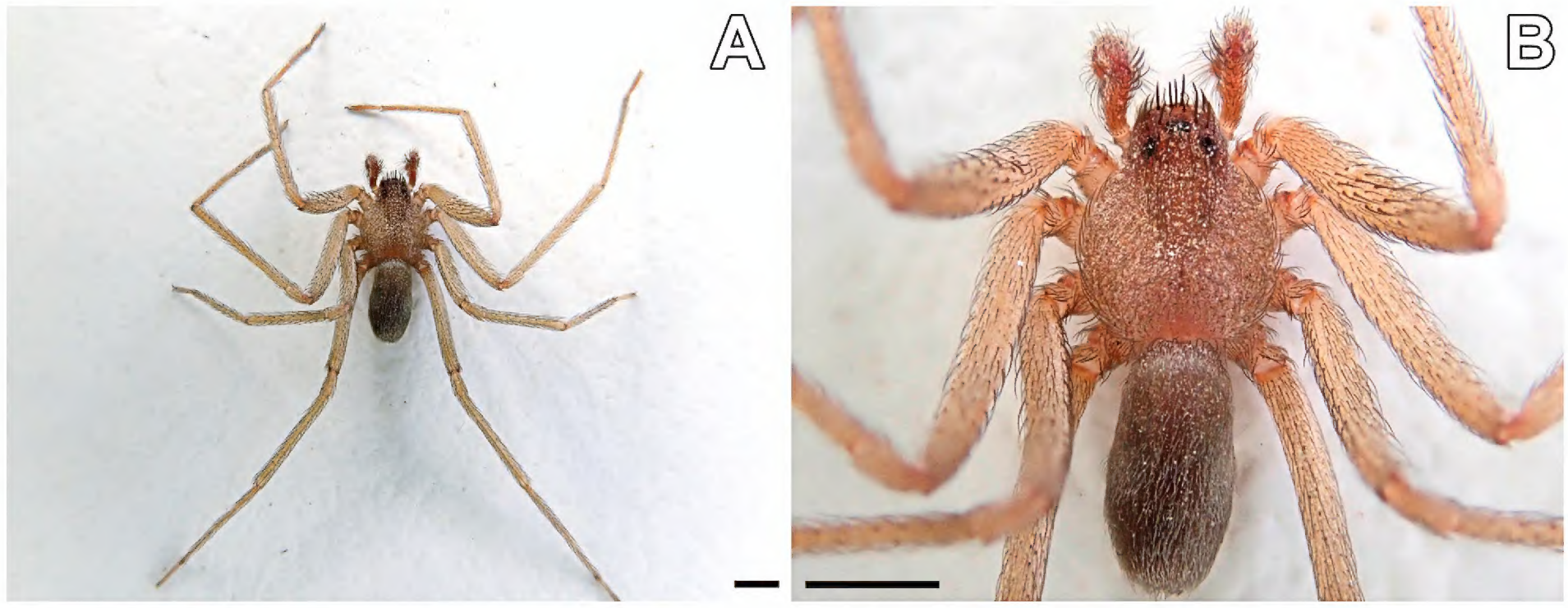

Figure 3. *Loxosceles vallenar*, live male specimen from Boquerón Chañar **A** entire specimen **B** close-up. Notice the clypeal setae. Scale bar: 1 mm.

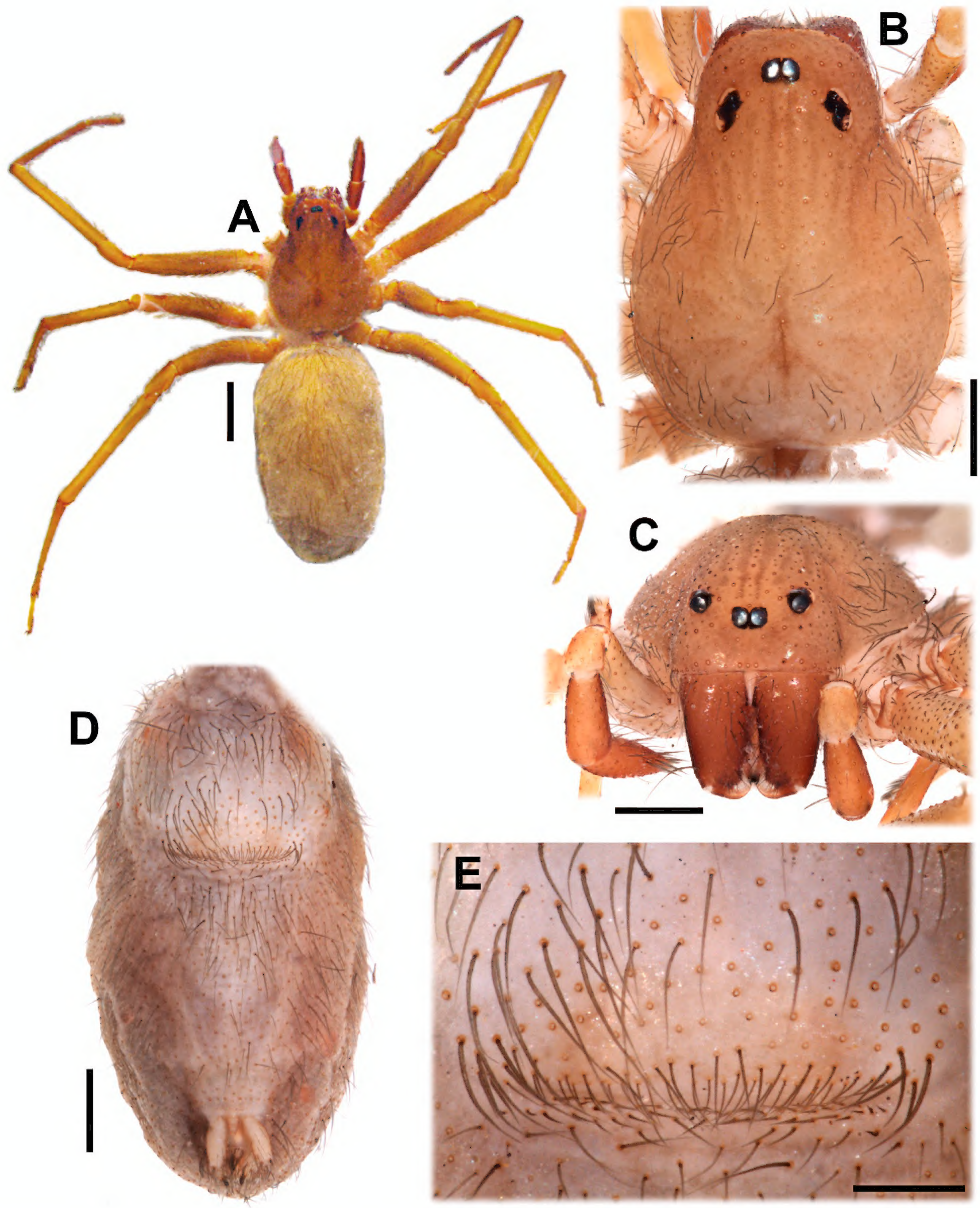

Figure 4. *Loxosceles vallenar* Brescovit, Taucare-Ríos, Magalhaes & Santos, females **A** holotype from Vallenar (AMNH), dorsal **B–E** female from Boquerón Chañar (MACN-Ar 44131) **B** dorsal **C** carapace, anterior **D** abdomen, ventral **E** genital region, ventral. Scale bars: 1000 μm (**A**); 500 μm (**B–D**); 200 μm (**E**).

Remarks. The genitalia of the holotype was incorrectly illustrated by Brescovit et al. (2017), as the digitiform, membranous median receptacles were overlooked. Re-examination of the holotype revealed they are present

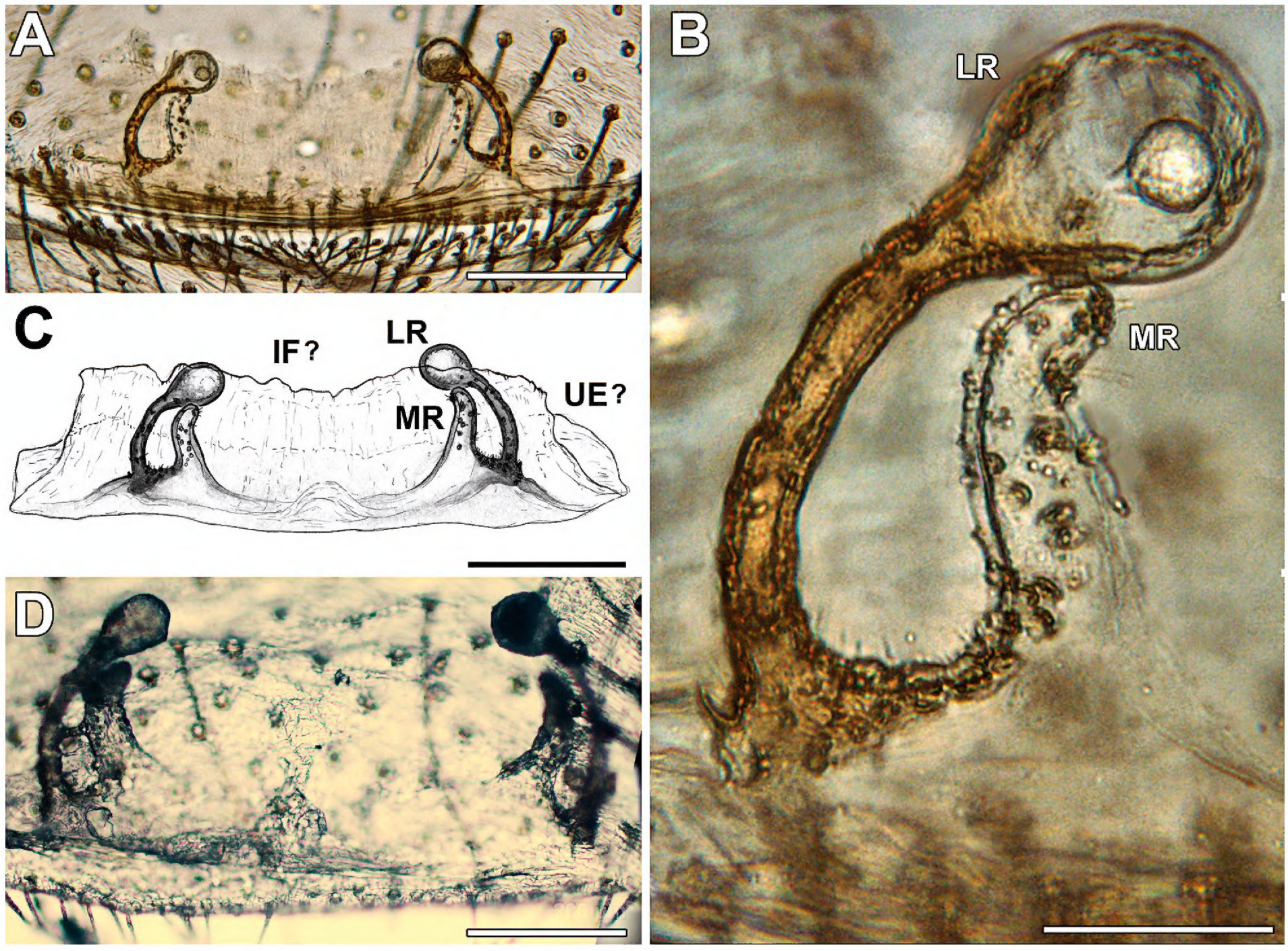

Figure 5. *Loxosceles vallenar*, median and lateral receptacles of the female genitalia **A–C** female from Boquerón Chañar (MACN-Ar 44131) **D** holotype from Vallenar (AMNH). Abbreviations: IF? = putative interpulmonary fold, LR = lateral receptacle, MR = median receptacle, UE? = putative uterus externus; details could not be resolved in light microscopy. Scale bars: 200 µm (**A, C, D**); 50 µm (**B**).

(Fig. 5D). We briefly describe the females collected with the males, especially their endogyne, which is in a better state than that of the holotype. The hitherto undescribed male has a palpal bulb bearing an embolic keel and overall morphology concordant with the *spadicea* species group (Figs 6–8). Thus, the species is moved from the *laeta* species group to the *spadicea* species group.

Diagnosis. Males resemble those of other members of the *spadicea* species group by the subtriangular cymbium in dorsal view (Fig. 6B) and embolus bearing a keel (Fig. 7C), but can be distinguished by the clypeus bearing macrosetae (Figs 3, 6A–C) (vs. clypeus without macrosetae) and by the more piriform, tapering copulatory bulb (Fig. 7B) (vs. bulb clearly globose; Gertsch 1967, figs 1, 4, 9). Females resemble those of other members of the *spadicea* species group by the short and digitiform median receptacle, but differ by the inwards curved base of the lateral receptacle (Fig. 5) (vs. base of the lateral receptacle sinuous to convoluted; Gertsch 1967, figs 11–14).

Description. Male from Boquerón Chañar, Atacama, Chile (MACN-Ar 44130). ***Coloration in ethanol*** (Fig. 6A). Carapace yellowish-brown with slightly darker pars cephalica, eyes surrounded by black pigment rings. Chelicerae orange brown. Labium light brown. Endites brownish-cream at base, darker

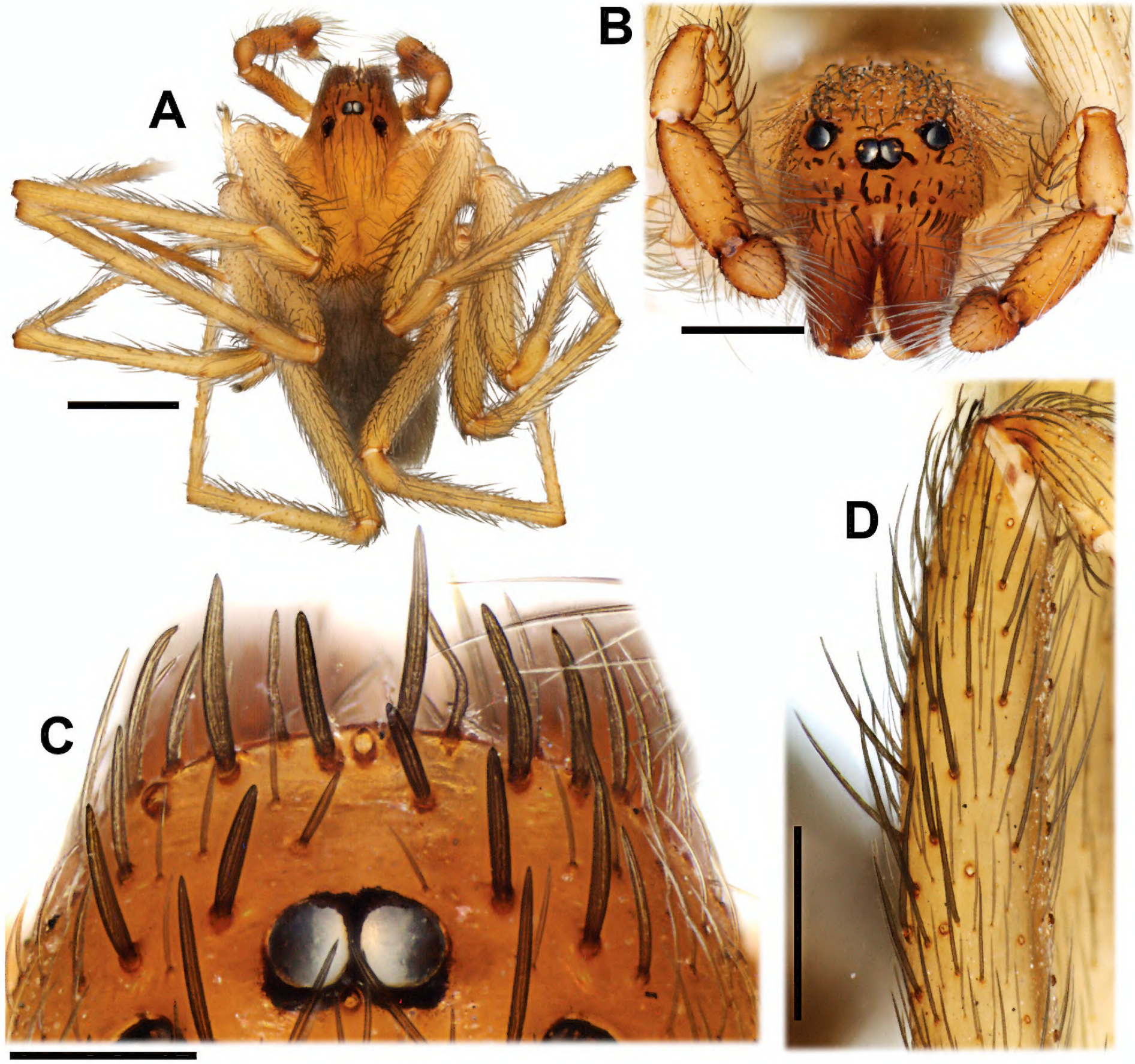

Figure 6. *Loxosceles vallenar*, male from Boquerón Chañar (MACN-Ar 44130) **A** habitus, dorsal **B** clypeus, anterior **C** clypeus, dorsal **D** left femur I, prolateral. Scale bars: 1000 μm (**A**); 500 μm (**B, D**); 200 μm (**C**).

at median third, whitish at tip. Palps yellowish-brown, tarsus darkest. Sternum brownish-cream. Legs uniformly light brown. Opisthosoma uniformly brownish-gray. ***Measurements.*** Total length 3.62. Carapace length 1.92, width 1.48. Clypeus height 0.23. Eye diameters and interdistances: ALE 0.11, PLE 0.12, PME 0.10, ALE–PME 0.13. Sternum length 1.13, width 0.95. Palp: femur length 1.08, height 0.18, tibia length 0.60, height 0.25, tarsus length 0.27. Leg I 8.6 (2.38, 0.58, 2.43, 2.38, 0.83). Leg II 10.11 (2.82, 0.59, 3.03, 2.84, 0.83). Leg III 7.53 (2.23, 0.57, 1.95, 2.14, 0.64). Leg IV 9.88 (2.82, 0.58, 2.75, 2.96, 0.77). Leg formula 2413. Abdomen: length 1.67, width 1.08. Femur I with ~17 prolateral macrosetae in a subdistal patch (Fig. 6D). Metatarsus I unmodified. Clypeus with ~20 macrosetae (Fig. 6C). ***Male genitalia*** (Figs 7, 8). Palpal femur with 5 prolateral macrosetae in apical third, tibia slightly swollen, with two pronounced condyles apically, cymbium short and subtriangular in dorsal

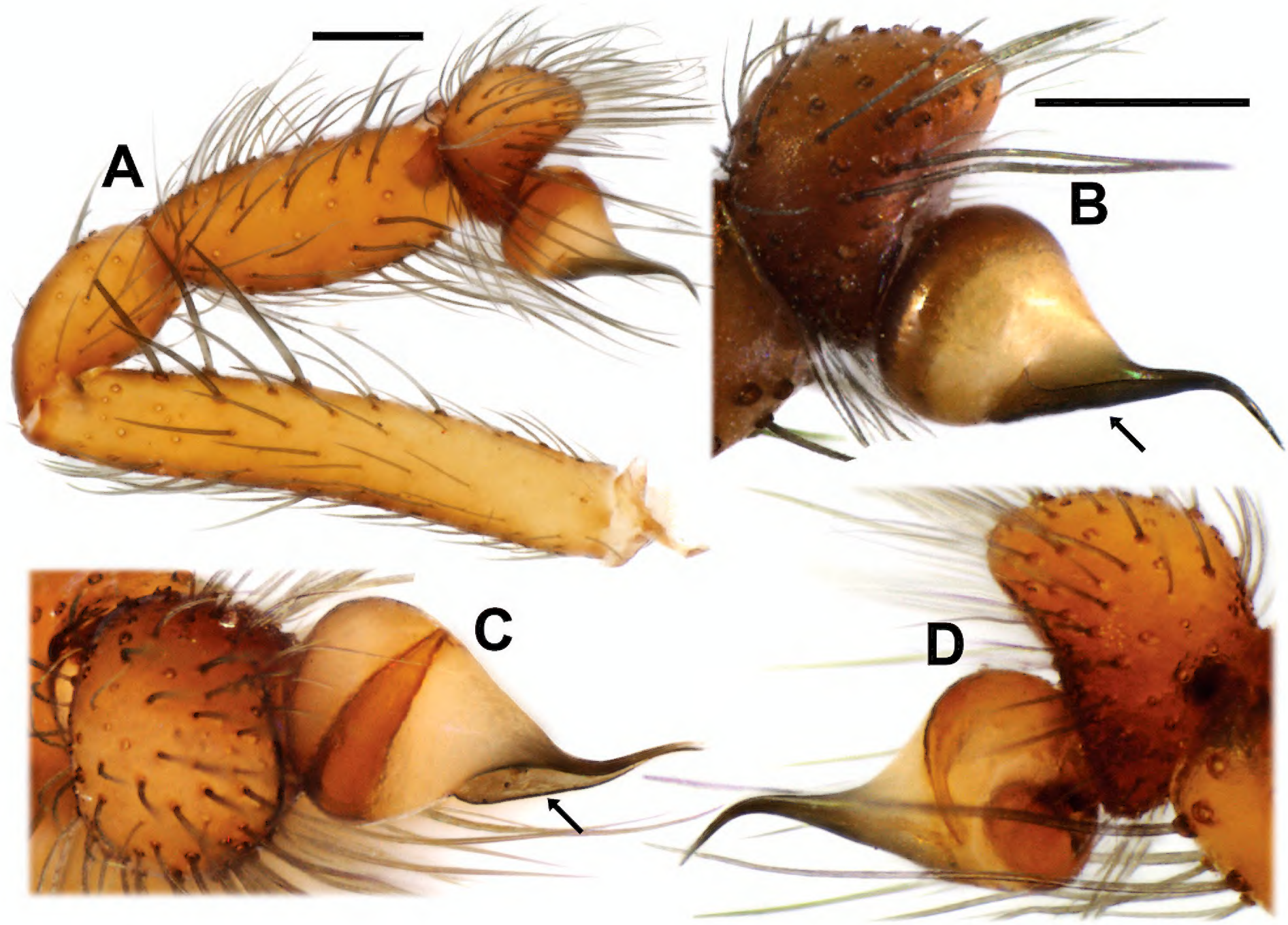

Figure 7. *Loxosceles vallenar*, males from Boquerón Chañar (MACN-Ar 44130) (except B, MACN-Ar 44129, dry specimen before sputter-coating), left palps **A, B** prolateral **C** dorsal **D** retrolateral. Arrows indicate embolic keel. Scale bars: 200 μm (**B–D** to the same scale).

view, bulb short and rounded, embolus curved and tapering retrolaterally, with a prolateral keel, without micro-spines (Fig. 8). State of the specimen: good; left palp dissected.

Female from Boquerón Chañar, Atacama, Chile (MACN-Ar 44131). Coloration and general structure as in the holotype (Fig. 4). Carapace length 2.20, width 1.68. Genital region externally pubescent but without stronger sclerotization (Fig. 4E). ***Endogyne*** (Fig. 5). Median receptacle digitiform, slightly sinuous and lightly sclerotized, bearing glandular pores throughout. Lateral receptacle with thin, sclerotized and arched base bearing glandular pores, leading to a rounded, unsclerotized head lacking pores; fold (presumably uterus externus and/or interpulmonary fold) short and membranous. State of the specimen: good; endogyne dissected.

Variation. The two males and two females examined have seemingly identical genitalia. Two males: total length 3.62 to 3.74; carapace length 1.92 to 1.97; tibia I length 2.43 to 2.73. Both females have a carapace length of 2.2 and vary in total length from 5.53 to 6.00.

Natural history. The label data indicates that the holotype was collected “in scrubby mountain-side, under rocks”. The specimens from Boquerón Chañar were collected at night, searching with headlights. The male specimens were actively walking on the ground.

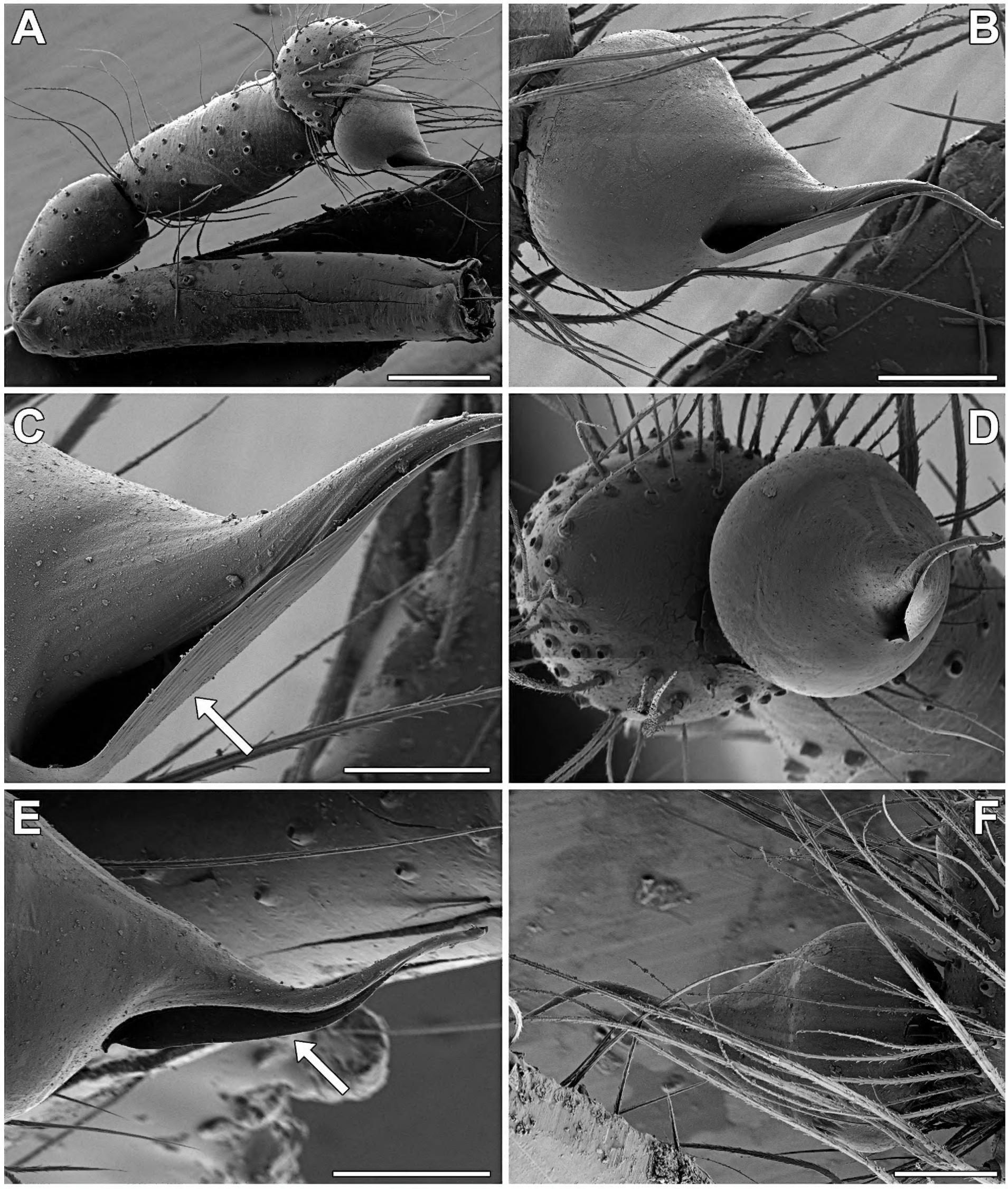

Figure 8. *Loxosceles vallenar*, male left palp (MACN-Ar 44129) under scanning electron microscopy **A** prolateral **B** bulb, prolateral **C** detail of embolic keel **D** bulb, apical **E** bulb, dorsal **F** bulb, retrolateral. Arrows indicate embolic keel. Scale bars: 200 μm (**A**); 100 μm (**B, E, F**); 50 μm (**C**).

Habitat. Specimens of *Loxosceles vallenar* and *L. vicentei* were collected in vegetation zones characterized by an inland Mediterranean-desert shrubland of *Adesmia argentea* Meyen and *Bulnesia chilensis* Gay (Luebert and Pliscoff 2006). These areas are defined by an extremely open shrubland with tall shrubs and the

presence of tree species. Shrubs include *A. argentea*, *Bulnesia chilensis*, *Balsamocarpon brevifolium* Clos, *Cordia decandra* Hook. & Arn., *Heliotropium sinuatum* (Miers) I.M. Johnst., *Pintoa chilensis* Gay, and *Proustia ilicifolia* Hook. & Arn. Additionally, low shrubs such as *Caesalpinia angulata* (Hook. & Arn.) Baill., *Encelia canescens* Lam., *Pleurophora pungens* D. Don, and cacti like *Cumulopuntia sphaerica* (C.F. Först.) E.F. Anderson and *Trichocereus coquimbanus* (Molina) Britton and Rose are common. Herbaceous plants abound during the rainy season, including species like *Cruckshanksia pumila* Clos and *Argylia irradian* (L.) D. Don. This entire environment is dominated by trees such as *Neltuma chilensis* (Molina) Hughes & Lewis, *Geoffroea decorticans* (Gillies ex Hook. & Arn.) Burkart, *Acacia caven* (Molina) Molina, and *Schinus polygama* (Cav.) Cabrera (Luebert and Pliscoff 2006) (Fig. 1). The climate in the area is semiarid subtropical Mediterranean in the northern margin and marine subtropical Mediterranean in the southern margin (Novoa and Villaseca 1989). The total precipitation recorded in the study area (Vallenar Station, 28°33'6.11"S, 70°47'25.92"W, 421 m.a.s.l.) in 2022 was 83.8 mm and was concentrated in July (66.5 mm) and June (4.9 mm) (CEAZA-Met 2024).

Distribution. Originally described from Vallenar, the new record extends the distribution of the species about 40 km northeastward. Both points are in Huasco Province, Atacama region, Chile (Fig. 2).

Loxosceles vicentei Taucare-Ríos, Brescovit & Villablanca, 2022

Fig. 9

Loxosceles vicentei Taucare-Ríos, Brescovit & Villablanca, 2022: 158, figs 1A–B, 2A–D, 4A–B.

Holotype (not examined). Chile • 1 ♂; Coquimbo, Elqui Prov., Vicuña, Fondo El Calvario, near Juntas del Toro, 29°58'30.97"S, 70°6'11.86"W, 2050 m.a.s.l., 14 Oct. 2021, V Villablanca Miranda, J Villablanca Rivera & A Taucare-Ríos leg.; Museo Nacional de Historia Natural, Santiago, Chile, MNNC 8371.

New record. Chile • 1 ♂; Atacama, Prov. Huasco, Boquerón Chañar; Algarrobal; 992 m.a.s.l., (28.3708°S, 70.4128°W); 24–25 Nov. 2022; J Pizarro-Araya, FM Alfaro, JE Barriga, AA Ojanguren-Affilastro, HA Iuri & JE Calderón leg.; IFM-2579; MACN-Ar 44128.

Remarks. The new record is about 183 km north of the type locality of *L. vicentei*, but within the distribution of this species presented by Taucare-Ríos et al. (2022). The embolic keel we observed in our specimens (Fig. 9, arrows) was not mentioned in the original description of the species but can nonetheless be seen in their figures (Taucare-Ríos et al. 2022, fig. 2A). The holotype has a slightly longer embolus and a seemingly larger keel; a larger series of specimens must be examined to evaluate the significance of these morphological differences. The presence of an embolic keel, allied with the digitiform median receptacles of the female (Taucare-Ríos et al. 2022, fig. 2D), hints that *L. vicentei* belongs in the *spadicea* species group, rather than in the *laeta* species group. Taucare-Ríos et al. (2022) present a map with four records, but their list of material examined indicated only three localities; the fourth record had been included by mistake (A. Taucare-Ríos, in litt.), and thus, we omit it in our map.

Habitat. See remarks under *L. vallenar* above.

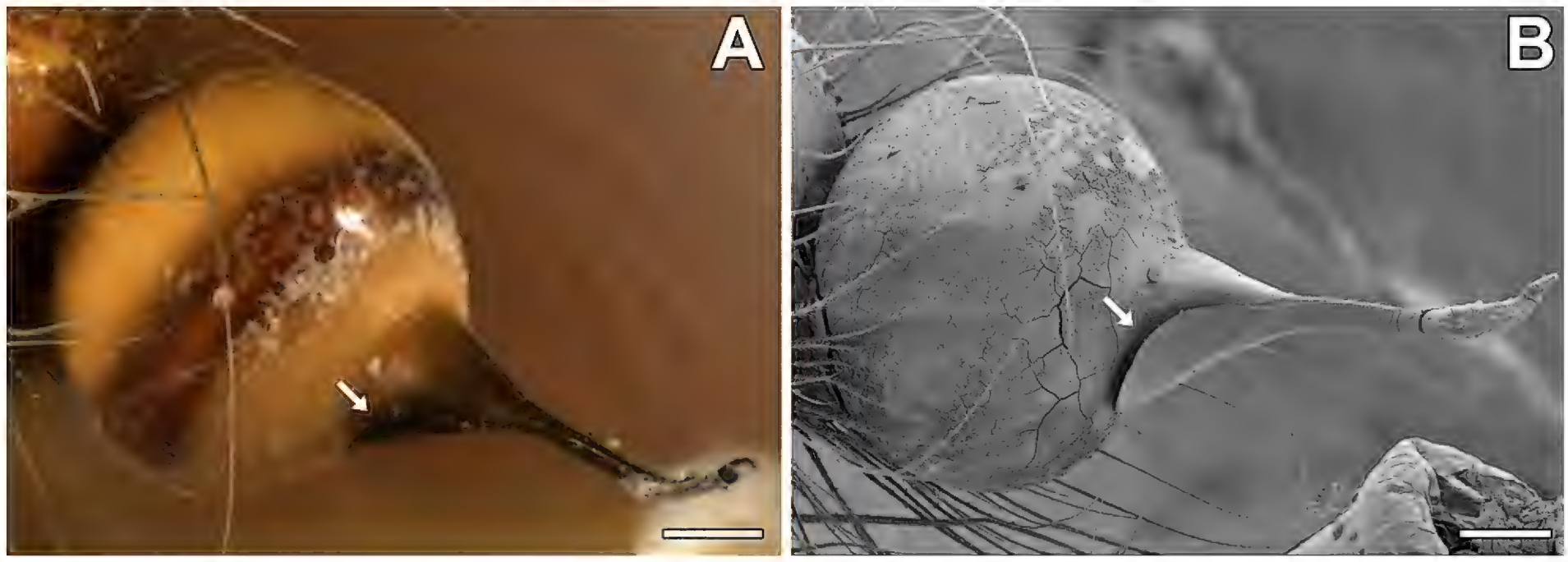

Figure 9. *Loxosceles vicentei* Taucare-Ríos, Brescovit & Villablanca, 2022, male from Boquerón Chañar (MACN-Ar 44128), left bulb, prolateral, in light (**A**) and scanning electron microscopy (**B**). Arrows indicate embolic keel. Scale bars: 100 μm.

Discussion

The newly described male indicates that *Loxosceles vallenar* is the smallest species among violin spiders. With a carapace length between 1.92 and 1.97, males are smaller than those of *Loxosceles dejagerae* Lotz, 2017 from South Africa (carapace lengths of 2.0–3.2; see Lotz 2017: 478), the previously smallest representative. Some other members of the *spadicea* group are also small, such as *L. spadicea* and *L. hirsuta* (carapace length 2.5; see Gertsch 1967).

The male of *Loxosceles vallenar* presents a secondary sexual character that has not been previously reported in the genus: a group of strong macrosetae in the clypeus. Secondary sexual characters in *Loxosceles* males are rare and usually associated with the legs, such as sinuous tibiae or metatarsi (see Brescovit et al. 2017; Bertani et al. 2018) or the presence of sexually dimorphic macrosetae patches (Bertani et al. 2018; Magalhaes et al. 2022). *Loxosceles vallenar* males also present a prolateral patch of macrosetae in the first femur. Presumably, some of these modifications of the legs may serve as clasping spurs during mating; for instance, *L. laeta* males grab the female coxae with their first legs during courtship and mating (Fischer 2007). This behavior is absent in *L. hirsuta* and *L. intermedia* (Fischer and Vasconellos-Neto 2000; Fischer and Silva 2001), whose males have unmodified legs. In these two species, however, males and females touch pedipalps during courtship, a very unusual behavior; we wonder if their embolic keel (see Gertsch 1967, fig. 3) plays a role in this. Regarding the clypeal macrosetae, several other Synspermiata (the clade where Sicariidae belongs) have males with modified clypei, such as *Relictocera* Li & Li (Psilodercidae), *Unicorn* Platnick & Brescovit (Oonopidae) and *Perania* Thorell (Pacullidae) (Lehtinen 1981; Platnick and Brescovit 1995; Chang et al. 2019). In most Synspermiata, the male faces the underside of the female during palpal insertions (see Fischer 2007). In this position, such clypeal modifications may help locking or stimulating the underside of the female. It remains to be tested if this is the case in *L. vallenar*.

We argue that *L. vallenar* and *L. vicentei* belong in the *spadicea* species group rather than in the *laeta* species group. Additionally, we re-examined the male of *Loxosceles coquimbo* described by Brescovit et al. (2017), revealing that its palpal bulb also bears an embolic keel, albeit small (Brescovit et al. 2017, fig.

2B). Together with the similar structure of the endogyne of *L. coquimbo* and *L. vicentei*, this suggests that the former also belongs in the *spadicea* species group. This indicates that the *spadicea* species group has diversified on both sides of the Andes: in Chile, it includes *L. diaguita*, *L. vallenar*, *L. coquimbo*, *L. vicentei*, and *L. pallalla*, which also possesses an embolic keel. East of the Andes, it includes *L. hirsuta*, *L. intermedia*, *L. spadicea* and *L. anomala*. The *laeta* group is thus represented in Chile only by two species: *L. surca* Gertsch, which occurs in Andean areas in the north of the country, and the synanthropic *L. laeta*.

Acknowledgments

We thank Lorenzo Prendini and Lou Sorkin (AMNH) for loan of specimens from the collection under their care. Fabián Tricárico aided in obtaining SEM images. We are indebted to Juan E. Barriga-Tuñon, Andres A. Ojanguren-Affilastro, Fermín M. Alfaro, and Juan E. Calderon for their assistance in the field. J.P-A thanks the Academic Excellence Scholarship (B134) from the Academic Vice-Rector's Office, Research and Postgraduate Studies of Universidad Santo Tomás, Santiago, Chile, and ANID doctoral fellowship 2024 (2024-21241400). Collecting permits were issued by Sistema de Monitoreo de Ecosistemas Forestales Nativos de Chile (SIMEF).

Additional information

Conflict of interest

The authors have declared that no competing interests exist.

Ethical statement

No ethical statement was reported.

Funding

This research was funded by Agencia Nacional de Promoción de la Investigación, el Desarrollo Tecnológico y la Innovación (PICT 2020-1907; ILFM), Consejo Nacional de Investigaciones Científicas y Técnicas (PUE-098; MACN), Conselho Nacional de Desenvolvimento Científico e Tecnológico (PQ 303903/2019-8; ADB), Fundação de Amparo à Pesquisa do Estado de São Paulo (2022/12588-1; ADB), DIDULS PR232128 and DIDULS PEQMEN212124 projects of Universidad de La Serena, La Serena, Chile, and through funding by the Ministry of Education of Chile, through MINEDUC's performance agreement: "Implementation of a competitive model of innovation and creation: preparing the University of La Serena for 2030, ULS19101", and to the project Climate Change and Sustainability in Coastal Zones of Chile (PFUE-RED21992) of the Ministry of Education of Chile.

Author contributions

Conceptualization: ILFM; Methodology: all authors; Formal analysis: ILFM; Investigation: all authors; Data Curation: ILFM; Writing – Original draft: all authors; Writing – Review and Editing: all authors; Funding Acquisition: ILFM, JPA.

Author ORCIDs

Ivan L. F. Magalhaes https://orcid.org/0000-0003-3728-3270
Hernán A. Iuri https://orcid.org/0000-0002-8094-9157

Antonio D. Brescovit https://orcid.org/0000-0002-1511-5324
Jaime Pizarro-Araya https://orcid.org/0000-0002-1595-6924

Data availability

All of the data that support the findings of this study are available in the main text.

References

Álvarez-Padilla F, Hormiga G (2008) A protocol for digesting internal soft tissues and mounting spiders for scanning electron microscopy. The Journal of Arachnology 35(3): 538–542. https://doi.org/10.1636/Sh06-55.1

Bertani R, Von Schimonsky DM, Gallão JE, Bichuette ME (2018) Four new troglophilic species of *Loxosceles* Heinecken & Lowe, 1832: Contributions to the knowledge of recluse spiders from Brazilian caves (Araneae, Sicariidae). ZooKeys 806: 47–72. https://doi.org/10.3897/zookeys.806.27404

Binford GJ, Callahan MS, Bodner MR, Rynerson MR, Núñez PB, Ellison CE, Duncan RP (2008) Phylogenetic relationships of *Loxosceles* and *Sicarius* spiders are consistent with Western Gondwanan vicariance. Molecular Phylogenetics and Evolution 49(2): 538–553. https://doi.org/10.1016/j.ympev.2008.08.003

Brescovit AD, Sánchez-Ruiz A (2016) Descriptions of two new genera of the spider family Caponiidae (Arachnida, Araneae) and an update of *Tisentnops* and *Taintnops* from Brazil and Chile. ZooKeys 622: 47–84. https://doi.org/10.3897/zookeys.622.8682

Brescovit AD, Taucare-Ríos A, Magalhaes ILF, Santos AJ (2017) On Chilean *Loxosceles* (Araneae: Sicariidae): first description of the males of *L. surca* and L. *coquimbo*, new records of *L. laeta* and three remarkable new species from coastal deserts. European Journal of Taxonomy 388: 1–20. https://doi.org/10.5852/ejt.2017.388

Bustamante AA, Scioscia CL, Casanueva ME (2014) A new species of *Admesturius* Galiano, 1988 from north Chile (Araneae: Salticidae: Amycoida). Zootaxa 3774: 197–200. https://doi.org/10.11646/zootaxa.3774.2.7

CEAZA-Met (2024) CEAZA-Met. https://www.ceazamet.cl/ [Accessed on 26 April 2024]

Chander G, Markham BL (2003) Revised Landsat 5 TM radiometric calibration procedures and post-calibration dynamic ranges. IEEE Transactions on Geoscience and Remote Sensing 41(11): 2674–2677. https://doi.org/10.1109/TGRS.2003.818464

Chang W-J, Li F, Li S (2019) On the genera *Qiongocera* and *Relictocera* (Araneae, Psilodercidae) from Southeast Asia. ZooKeys 862: 61–79. https://doi.org/10.3897/zookeys.862.33078

Chávez PS (1996) Image-based atmospheric corrections-revisited and improved. Photogrammetric Engineering and Remote Sensing 62(9): 1025–1036.

Fischer ML (2007) Comportamento sexual de *Loxosceles laeta* (Nicolet) (Araneae, Sicariidae): Influência da idade da fêmea. Revista Brasileira de Zoologia 24(4): 865–872. https://doi.org/10.1590/S0101-81752007000400002

Fischer ML, Silva EM (2001) Comportamento sexual de *Loxosceles hirsuta* Mello-Leitão, 1931 (Aranae: Sicariidae). Estudos de Biologia 47: 7–14.

Fischer ML, Vasconcellos-Neto J (2000) Comportamento sexual de *Loxosceles intermedia* Mello-Leitão, 1934 (Araneae, Sicariidae). Revista de Etologia 2: 31–42.

Gertsch WJ (1967) The spider genus *Loxosceles* in South America. Bulletin of the American Museum of Natural History 136: 121–182. https://doi.org/10.1038/113141b0

Griotti M, Grismado CJ, Roig-Juñent S, Ramírez MJ (2022) Taxonomy and phylogenetic analysis of the South American genus *Petrichus* Simon (Araneae: Philodromidae)

provide new insights into the running crab spiders' phylogeny. Invertebrate Systematics 36(4): 306–353. https://doi.org/10.1071/IS21068

Grismado CJ, Pizarro-Araya J (2016) The spider genus *Cyrioctea* Simon on Chañaral Island (Pingüino de Humboldt National Reserve, Atacama, Chile): Description of a new species, and the male of *Cyrioctea cruz* Platnick (Araneae, Zodariidae). Zootaxa 4107(2): 267–276. https://doi.org/10.11646/zootaxa.4107.2.8

IGM (1986) Cartas de Región de Coquimbo y Región de Atacama. 1:250.000. Santiago de Chile. Instituto Geográfico Militar de Chile. https://www.igm.cl/?page=descargas-gratuitas-igm [Last accessed in 25/04/2024]

Keyserling E (1880) Die Spinnen Amerikas. Laterigradae. [Erster Band]. Bauer & Raspe, Nürnberg, 283 pp. [pl. 1–8] https://doi.org/10.5962/bhl.title.64832

Laborda Á, Ramírez MJ, Pizarro-Araya J (2013) New species of the spider genera *Aysenia* and *Aysenoides* from Chile and Argentina: description and phylogenetic relationships (Araneae: Anyphaenidae, Amaurobioidinae). Zootaxa 3731(1): 133–152. https://doi.org/10.11646/zootaxa.3731.1.6

Lehtinen PT (1981) Spiders of the Oriental-Australian region. III. Tetrablemmidae, with a world revision. Acta Zoologica Fennica 162: 1–151.

Lotz LN (2017) An update on the spider genus *Loxosceles* (Araneae: Sicariidae) in the Afrotropical region, with description of seven new species. Zootaxa 4341(4): 475–494. https://doi.org/10.11646/Zootaxa.4341.4.2

Lowe RT (1832) Descriptions of two species of Araneidae, natives of Madeira. The Zoological Journal 5(19, 1831): 320–323. [pl. 17–18]

Luebert F, Pliscoff P (2006) Sinopsis Bioclimática y Vegetacional de Chile. Editorial Universitaria, Santiago, Chile, 316 pp.

Magalhaes ILF (2019) Spreadsheets to expedite taxonomic publications by automatic generation of morphological descriptions and specimen lists. Zootaxa 4624(1): 147–150. https://doi.org/10.11646/zootaxa.4624.1.12

Magalhaes ILF, Neves DM, Santos FR, Vidigal THDA, Brescovit AD, Santos AJ (2019) Phylogeny of Neotropical *Sicarius* sand spiders suggests frequent transitions from deserts to dry forests despite antique, broad-scale niche conservatism. Molecular Phylogenetics and Evolution 140: 106569. https://doi.org/10.1016/j.ympev.2019.106569

Magalhaes ILF, Pérez-González A, Labarque FM, Carboni M, Hammel JU, Kunz R, Ramírez MJ, Solórzano-Kraemer MM (2022) Revision of recluse spiders (Araneae: Sicariidae: *Loxosceles*) preserved in Dominican amber and a total evidence phylogeny of Scytodoidea reveal the first fossil Drymusidae. Arthropod Systematics & Phylogeny 80: 541–559. https://doi.org/10.3897/asp.80.e86008

Mittermeier RA, Turner WR, Larsen FW, Brooks TM, Gascon C (2011) Global biodiversity conservation: the critical role of hotspots. In: Zachos F, Habel J (Eds) Biodiversity Hotspots. Springer, Berlin, Heidelberg, 3–22. https://doi.org/10.1007/978-3-642-20992-5_1

Myers N, Mittermeier RA, Mittermeier CG, Fonseca GA, Kent J (2000) Biodiversity hotspots for conservation priorities. Nature 403(6772): 853–858. https://doi.org/10.1038/35002501

Nicolet H (1849) *Arácnidos*. In: Gay C (Ed.) Historia física y política de Chile. Zoología 3: 319–543. [pl. 1–5. Paris, Thunot]

Novoa SA, Villaseca S (1989) Mapa agroclimático de Chile Investigaciones Agropecuarias. INIA, Santiago, Chile, 216 pp.

Platnick NI, Brescovit AD (1995) On *Unicorn*, a new genus of the spider family Oonopidae (Araneae, Dysderoidea). American Museum Novitates.American Museum Novitates 3152: 1–12.

Schenone H, Saavedra T, Rojas A, Villaroel F (1989) Loxoscelismo en Chile: Estudios epidemiológicos, clínicos y experimentales. Revista do Instituto de Medicina Tropical de São Paulo 31(6): 403–415. https://doi.org/10.1590/S0036-46651989000600007

Taucare-Ríos A, Brescovit AD, Villablanca J (2022) A new species of *Loxosceles* Heineken & Lowe, 1832 (Araneae: Sicariidae) from Chile. Revista Chilena de Entomologia 48(1): 157–164. https://doi.org/10.35249/rche.48.1.22.15

Vergara-Asenjo G, Alfaro FM, Pizarro-Araya J (2023) Linnean and Wallacean shortfalls in the knowledge of arthropod species in Chile: Challenges and implications for regional conservation. Biological Conservation 281: 110027. https://doi.org/10.1016/j.biocon.2023.110027

World Spider Catalog (2024) World Spider Catalog. Version 25.0. Natural History Museum Bern. https://doi.org/10.24436/2 [Accessed on 09 February 2024]